



## **The Effects of Aerobic Training on Depression and Resilience among Healthcare Workers**

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### **Abstract**

**Background:** Identifying factors that can positively influence the mental health and resilience of healthcare workers is crucial. As such, this research aims to explore the impact of aerobic exercise on depression and resilience among healthcare workers.

**Methods:** This study was conducted as an experiment, focusing on healthcare workers employed in hospitals in Tehran. A sample of 64 health care workers was selected using a convenience sampling method. These individuals were then randomly divided into two control groups (32 people each) and one experimental group (32 people). Data was collected using standard questionnaires. T tests and ANCOVA were used to analyze data.

**Results:** The results showed that there is no significant difference in both depression and resilience in the pretest (both  $P > 0.05$ ). However, it was observed that experimental group had significantly lower depression and higher resilience compared to control group in the posttest (both  $P = 0.001$ ). Finally, the results of ANCOVA showed significant differences between experimental and control groups in both depression and resilience (both  $P = 0.001$ ).

**Conclusions:** These results suggest that physical activity and sport can be considered as an important factor in coping with severe job-related conditions in healthcare workers. Therefore, by increasing physical activity and sport, better conditions can be created for healthcare workers to ensure their mental health.

**Keywords:** Aerobic, Sport, Depression, Resilience, Healthcare

## **Introduction**

Depression is a widely prevalent condition often referred to as a psychiatric cold. The key characteristic of this condition is a minimum two-week period marked by either a depressed mood or a loss of interest and pleasure in nearly all activities (American Psychological Association, 2014; Davidson, 2003; Jolivet, et al. 2010). Symptoms may include changes in appetite or weight, disruptions in sleep patterns and psycho-motor functions, fatigue, decreased energy levels leading to impaired social, occupational, and academic performance, feelings of worthlessness and guilt, cognitive difficulties, and suicidal ideation or behaviors. Suicide is a grave consequence of depression (Masten, 2001; Sadeghipor & Aghdam, 2021). Recent research indicates that major depressive disorder has the highest lifetime prevalence (around 17%) among psychiatric illnesses. Studies involving student populations have also revealed a significant prevalence of this disorder. While drug therapy and various forms of cognitive therapy have shown efficacy in treating major depressive disorders, their effectiveness diminishes in milder cases (Sadeghpour & Sangchini, 2020; Taso, et al. 2014). Moreover, these treatments are resource-intensive, costly, and may have adverse effects. Hence, there is a pressing need to explore non-pharmacological interventions for different severity levels of depression.

Several research studies have explored the impact of exercise on depression, revealing that physical activity is effective in alleviating symptoms of depression (Abdi, et al. 2022; Afsanepurak, et al. 2012; Dana & Shams, 2019; Dana, et al. 2021; Ghorbani & Bund, 2014, 2016; 2017; Ghorbani, et al. 2020; Khosravi et al. 2023; Moradi, et al. 2020; Sadeghipor & Aghdam, 2021; Sadeghipor, Aghdam, & Kabiri, 2021; Sadeghipor, Kabiri & Aghdam, 2021; Seyedi-Asl, et al. 2021; Seyedi-Asl, et al. 2016; Taghva, et al. 2020). For instance, a study involving 43 depressed women found that those who engaged in aerobic exercise experienced a greater reduction in depression compared to those who participated in relaxation exercises or received no intervention (Chris, et al. 2010). In a separate study, 12 patients diagnosed with major depression underwent a 30-minute daily aerobic training session for 10 days, resulting in a significant improvement in mood (Ellis, et al. 2013). Another study focused on the effects of physical exercise on depression, neuroendocrine stress hormones, and overall well-being in young women with depressive symptoms. This study, which involved 49 volunteer participants, demonstrated that an 8-week exercise program led to a significant decrease in depression scores (Faircloth, 2017).

In the realms of developmental psychology, family psychology, and mental health, resilience has garnered significant attention. Resilience, in essence, refers to the successful adaptation to challenging circumstances, encompassing a process, ability, or outcome. It is important to note that resilience extends beyond mere stability against harm or threats, as it involves active and constructive engagement with one's environment (Bandura, 1997; Conner & Davidson, 2003; Hartfiel, et al. 2011; Herrick, et al. 2020). Essentially, resilience entails an individual's capacity to uphold a state of biological-psychological equilibrium amidst perilous situations. Moreover, resilience has been recognized as a safeguarding element in the realm of mental health and the

facilitation of growth (Letvak, Ruhm, & McCoy, 2012; Mikkelsen, et al. 2017; Newhan, et al. 2014; Ohler, et al. 2010).

Healthcare professionals worldwide are at an increased risk of facing negative mental health consequences. Studies indicate that these individuals often grapple with high levels of psychological distress, anxiety, emotional fatigue, and burnout. Notably, depression is a major concern among healthcare workers, with rates ranging from 21.53% to 32.77% in high-income nations - significantly higher than the global average of 4.40% in 2015 (Ramachandra, et al. 2013; Ulger & Yagli, 2010; Vasconcelos, et al. 2013; Sharma, 2014). The demanding nature of their academic and professional responsibilities, coupled with personal stressors, can have a detrimental impact on their overall well-being. Consequently, healthcare workers not only endure prolonged exposure to stress but may also see a decline in the quality of care they provide to patients. This can result in patient dissatisfaction, increased turnover rates within the healthcare workforce, medical mistakes, and heightened financial burdens. Therefore, identifying factors that can positively influence the mental health and resilience of healthcare workers is crucial. As such, this research aims to explore the impact of aerobic exercise on depression and resilience among healthcare professionals.

## **Methods**

This study was conducted as an experiment, focusing on healthcare workers employed in hospitals in Tehran. The research included a statistical population consisting of all healthcare workers in these hospitals. For the study, a sample of 64 health care workers was selected using a convenience sampling method. These individuals were then randomly divided into two control groups (32 people each) and one experimental group (32 people). In order to participate in the study, the participants had to meet certain criteria, including not receiving any drug treatment, and demonstrating both the ability and willingness to take part in the study. Additionally, individuals with any clear disorder or those who failed to complete the exercise protocol were excluded from the study.

The assessment of depression was conducted using the Depression, Anxiety, Stress Scale-21 (DASS-21) (Letvak, Ruhm, & McCoy, 2012). This specific subscale consists of seven items, with responses ranging from "did not apply to me at all" to "applied to me very much, or most of the time." The total score ranges from zero to 21, where a higher score indicates a higher level of depression. Scores falling between 0-4 suggest a normal condition, 5-6 indicate mild depression, 7-10 indicate moderate depression, 11-13 indicate severe depression, and 14+ indicate extremely severe depression. Furthermore, the Cronbach's alpha coefficient was determined to be 0.92.

Connor and Davidson (2003) developed a Resilience Scale comprising of 25 items. This scale employs a five-point Likert scale, with responses ranging from 1 ("strongly disagree") to 5 ("strongly agree"). Increased scores on this scale indicate higher levels of resilience. The creators of this questionnaire suggest that it can effectively differentiate between individuals who are

resilient and those who are not, in both clinical and non-clinical populations. Furthermore, they believe that it has the potential to be utilized in research and clinical settings. In the current study, the reliability of this scale was confirmed with a Cronbach's alpha coefficient of 0.90.

The aerobic training program spanned over a period of eight weeks, with two sessions scheduled per week. Prior to each session, participants were required to arrive at the training hall 30 minutes early. During this time, an expert coach provided them with instructions on aerobic exercises, as well as guidance on measuring carotid and wrist pulses. The session itself consisted of several components. Firstly, the resting heart rate was measured and recorded using either the carotid or wrist pulse. The exercise then commenced with warm-up exercises, stretching, concentration techniques, and basic breathing exercises. Typically, the movements began from either the head and neck or the feet, gradually progressing with gentle tapping. This initial stage lasted for approximately 10 minutes. Subsequently, the movements were performed with increased intensity, targeting a moderate heart rate range of 0.60-0.80. During this stage, participants engaged in faster movements of their arms and legs, both separately and in various combinations. The heart rate was monitored and recorded using either the carotid pulse or the wrist. This stage lasted for approximately 30-35 minutes. The final stage of the session involved a cooling down period, during which the movements were performed with reduced intensity. This stage lasted for about 10-15 minutes. The control group, on the other hand, did not receive any treatment and were instructed to refrain from participating in any sports or therapeutic activities until the completion of the sessions.

The data underwent statistical analysis using SPSS software version 26. The normality of the quantitative data distribution was determined using the Kolmogorov-Smirnov test. To compare the difference between pre-tests and post-tests within each group across all scales, the paired t-test was employed. The covariance test was utilized to compare the difference between the pre-test and post-tests between the two groups, as well as to compare the average scores and the difference between the pre-test and post-test scores within each group across the two groups. Independent t test was used for calculating the differences between posttests of two groups. The level of significance was set at  $P < 0.05$ .

## Results

Table 1 presents the mean and standard deviation of individual characteristics of the subjects, including age, height, weight, and body mass index (BMI).

Table 1. Demographic features of the participants

Indicator	Group	No.	mean±SD	P
Age (year)	Control	32	32.84±8.91	0.79
	Training	32	31.99±7.28	
Height (M)	Control	32	1.65±0.07	0.87
	Training	32	1.66±0.05	
Weight (Kg)	Control	32	70.17±3.47	0.77
	Training	32	71.27±2.64	

<b>Body mass index (Kg/M<sup>2</sup>)</b>	Control	32	24.36±1.19	0.46
	Training	32	24.49±1.28	

First of all, the results of Kolmogorov-Smirnov tests showed that all research variables had normal distribution (all  $P > 0.05$ ). The results of the paired-sample t-test (Table 2) revealed a significant influence of the aerobic training on depression ( $P = 0.001$ ) and resilience ( $P = 0.001$ ) among the individuals in the training group from the pretest to the posttest. Conversely, there were no significant differences in the impact observed between the pre- and post-tests in the control group for both depression and resilience ( $P > 0.05$ ).

Table 2. Paired-sample t test results for intra-group comparison of depression and resilience

	<b>Control Group</b>		t	P	<b>Training Group</b>		t	P
	Pretest	Posttest			Pretest	Posttest		
<b>Depression</b>	9.93±2.17	10.02±2.20	0.201	0.57	9.87±2.69	7.31±1.75	6.57	0.001
<b>Resilience</b>	62.08±10.27	61.22±9.83	0.187	0.66	63.29±8.71	78.38±12.67	11.84	0.001

Table 3 presents the findings of the covariance test analysis conducted to compare the two groups. According to Table 3 and the level of significance is 0.001, which is less than 0.05, there is a significant difference between the estimated mean depression scores of experimental and control subjects, and the amount of difference indicates that 65.21% of the variance of the post-test scores is due to the effect of aerobic training on depression. Therefore, aerobic training is effective on the depression of the healthcare workers, and according to the averages, it has reduced the amount of depression.

Table 3. Analysis of covariance test outcomes for inter-group evaluation of depression

	<b>Sum of squares</b>	<b>df</b>	<b>Mean of squares</b>	<b>F</b>	<b>P</b>	<b>Eta squared</b>
<b>Pretest</b>	3947.612	1	3947.612	16.169	0.001	21.08
<b>Group</b>	36247.228	1	36247.228	200.17	0.001	73.28
<b>Error</b>	3093.515	47	124.616			

Table 4 presents the findings of the covariance test analysis conducted to compare the two groups. According to Table 4 and the level of significance is 0.001, which is less than 0.05, there is a significant difference between the estimated mean resilience scores of experimental and control subjects, and the amount of difference indicates that 72.55% of the variance of the post-test scores is due to the effect of aerobic training on resilience. Therefore, aerobic training is effective on the resilience of the healthcare workers, and according to the averages, it has increased the amount of resilience.

Table 4. Analysis of covariance test outcomes for inter-group evaluation of resilience

	<b>Sum of squares</b>	<b>df</b>	<b>Mean of squares</b>	<b>F</b>	<b>P</b>	<b>Eta squared</b>
<b>Pretest</b>	4487.697	1	4487.697	10.965	0.001	7.01
<b>Group</b>	40278.368	1	40278.368	120.95	0.001	56.39
<b>Error</b>	3265.029	47	91.749			

The Independent t test results (Table 5) indicated a significant difference in the post-test results between the control and training groups ( $P=0.001$ ). More precisely, the training group exhibited a significant improvement in depression and resilience in comparison to the control group.

Table 5. Results of Independent t test to investigate the difference inter-groups in depression and resilience

	Test stage	t	P
<b>Depression</b>	Posttest	8.497	0.001
<b>Resilience</b>	Posttest	7.694	0.001

## Discussion

Identifying factors that can positively influence the mental health and resilience of healthcare workers is crucial. As such, this research aims to explore the impact of aerobic exercise on depression and resilience among healthcare workers. The results of the current study indicated that individuals engaging in aerobic exercise experienced a significant reduction in depression scores when compared to the control group and their own scores prior to exercise. This finding is in line with those of previous studies (Khosravi et al. 2023; Moradi, et al. 2020; Sadeghipor & Aghdam, 2021; Sadeghipor, Aghdam, & Kabiri, 2021; Sadeghipor, Kabiri & Aghdam, 2021; Seyedi-Asl, et al. 2021; Seyedi-Asl, et al. 2016; Taghva, et al. 2020). Various factors may contribute to this observation, with one such factor being biological processes. The data presented align more closely with the theory suggesting that mood disorders involve diverse regulations in biological amines. Norepinephrine and serotonin are two key biological amine neurotransmitters that play a significant role in the pathophysiology of mood disorders (Bandura, 1997; Conner & Davidson, 2003; Hartfiel, et al. 2011; Herrick, et al. 2020). While there are theories proposing the involvement of dopamine in depression, it appears that the levels of this neurotransmitter decrease in cases of depression. Several studies have explored the relationship between noradrenaline, serotonin, dopamine, and exercise, despite variations in experimental protocols. The findings suggest that there is support for alterations in the synthesis and metabolism of monoamines during physical activity. Furthermore, there is additional evidence indicating that exercise can impact the concentration of neurotransmitters in the nervous system. Physical exercise has the potential to serve as a therapeutic approach in managing severe depression by enhancing the release of neurotransmitters (Dana, et al. 2021; Ghorbani & Bund, 2014). According to the British National Health Association, exercise leads to an increase in serotonin levels in the brain. Another factor contributing to the outcomes of this research may be linked to psychological variables. For instance, research has demonstrated that exercise not only reduces depression but also boosts self-esteem. In a separate study, it was revealed that the severity of depression is inversely related to changes in effective coping and event memory (Masten, 2001; Sadeghipor & Aghdam, 2021). Overall, this study highlights the positive cognitive and psychological transformations associated with exercise in individuals with depression.

In addition, the research findings indicate that participating in an aerobic exercise course can enhance the resilience of healthcare workers. This outcome aligns with previous research

(Davidson, 2003; Jolivet, et al. 2010) and demonstrates the positive impact of sports involvement on resilience. When explaining the resilience-related results, it can be observed that athletes with higher ambiguity tolerance are less likely to avoid uncertain situations. Instead, they effectively utilize available resources to navigate challenging circumstances. It is important to note that sports conditions, including competitions, often involve unpredictability and ambiguity. Individuals who solely excel in unambiguous environments may struggle in such situations (Ramachandra, et al. 2013; Ulger & Yagli, 2010; Vasconcelos, et al. 2013; Sharma, 2014). Athletes with higher tolerance for ambiguity and resilience, on the other hand, are better equipped to handle and manage ambiguous and difficult scenarios, as well as anxiety-inducing pressures. As resilience increases, so does psychological toughness, and conversely, individuals with heightened resilience and psychological toughness experience reduced treatment anxiety.

## Conclusion

The results of the current study indicated that engaging in aerobic exercise resulted in a significant reduction in depression and also an increment in resilience. These results suggest that physical activity and sport can be considered as an important factor in coping with severe job-related conditions in healthcare workers. Therefore, by increasing physical activity and sport, better conditions can be created for healthcare workers to ensure their mental health. Our findings can have practical implications for healthcare responsibilities. Accordingly, it is suggested that healthcare responsibilities encourage healthcare workers to engage in physical activity and sport such as aerobic to improve their mental health.

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